

REMARKS

Claims 21-59 are pending in this application. Claims 30-59 are presently withdrawn from consideration. Claims 21, 30, 41, and 53 are amended without introduction of new subject matter. Non-limiting support for amended claim 21 is provided at least by Applicants' Figures 5 and 7 and their corresponding written descriptions. Claims 30, 41, and 53 are amended to recite the electrode of claim 21. As claims 30, 41, and 53 recite all features of claim 21, Applicants respectfully request the Examiner to rejoin claims 30, 41, and 53, under MPEP 821.04(b), in the event that claim 21 is found to be allowable.

Claims 21-29 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Applicants' Figure 2 (from this application's "Background of the Invention" section) in view of U.S. Patent No. 7,074,709 to Young. This rejection is respectfully traversed.

As noted in a pre-appeal brief submitted March 29, 2007 in this application, Applicants' invention addresses a problem within the prior art. As shown by Applicants' Figure 1B (below), a conventional electrode structure 100 has an arrangement of an adhesion/barrier layer 110 between first and second conductive layers 102, 112, which causes the upper electrode contact surface to consist of upper surfaces of layers 110, 112. Consequently, there is an undesirable variation in work function across the electrode contact surface. For instance, when used in conjunction with an array of programmable resistance memory devices, the work function differences in upper electrode contact surfaces of layers 110, 112 can cause a variation in the threshold switching voltage of each device. Applicants' disclosure, para. 5.

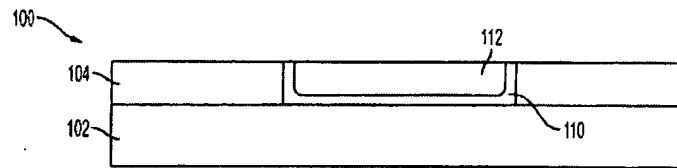


FIG. 1B

Applicants' claimed invention solves the multiple work function problem by providing, in part, "a third conductive layer formed over and at least partially in direct physical contact with said second conductive layer and said adhesion layer within said opening, wherein said third conductive layer is recessed within said opening in said dielectric layer". Non-limiting examples of the claimed invention are provided by Applicants' Figures 5 and 7, shown below. In both examples, the claimed elements correspond to the following illustrated components: first conductive layer (102); dielectric layer (104); adhesion layer (110); second conductive layer (112); and third conductive layer (114), which is over the upper surfaces of layers 110 and 112. Figure 7 further illustrates a top electrode 210 and memory element 200, provided on the third conductive layer (114). The additional (third) conductive layer 114 mitigates problems with having two different materials and associated work functions in contact with memory element 200.

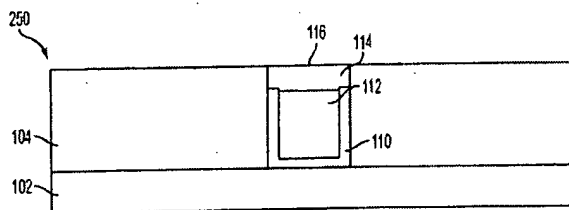


FIG. 5

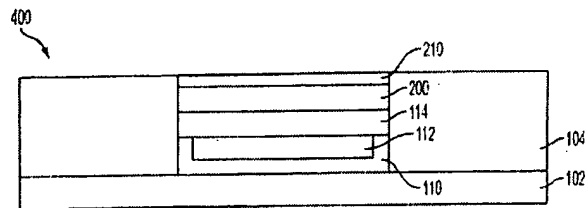


FIG. 7

Accordingly, claim 21 recites "an electrode comprising: a first conductive layer; a dielectric layer over said first conductive layer, said dielectric having an opening exposing a portion of said first conductive layer; an adhesion layer over in said opening in said

dielectric layer and over said exposed portion of said first conductive layer; a second conductive layer formed at least partially over said adhesion layer, wherein said second conductive layer and said adhesion layer are recessed within said opening in said dielectric layer; and a third conductive layer formed over and in direct physical contact with said second conductive layer and said adhesion layer within said opening, wherein said third conductive layer is recessed within said opening to cap said second conductive layer and said adhesion layer within said opening." Claims 22-29 depend from claim 21.

The third conductive layer can electrically connect the second conductive layer and adhesion layer with a device, e.g., a memory element, without having the different materials of the second conductive layer and the adhesion layer in contact with the device; and can thereby address the work function problem described above. The third conductive layer achieves this advantageous feature by being "formed over and at least partially in direct physical contact with said second conductive layer and said adhesion layer within said opening" and "recessed within said opening to cap said second conductive layer and said adhesion layer within said opening."

The Office Action cites Applicants' Figure 2 as teaching a first conductive layer (102), a dielectric layer (104), an adhesion layer (110), a second conductive layer (112), and a third conductive layer (210). The Office Action acknowledges that Applicants' Figure 2 does not teach all features of claim 21, stating that it "teaches the third conductive layer (210), but does not teach the third conductive layer is in direct physical contact with the second conductive layer and the adhesion layer with the opening." Office Action, January 28, 2008, page 3. To remedy this deficiency, the Office Action further states:

However, Young teaches the third conductive layer (38) is partially in direct physical contact with the second conductive layer (34) and the adhesion layer (36)

within the opening (col. 7, lines 20-35 and Fig. 3A). ... It would have been obvious ... to form a third conductive layer in direct physical contact with the second conductive layer and the adhesion layer in order to obtain an electrical connection between second interconnection and the via as taught by Young, column 7, lines 20-35.

[Office Action, January 28, 2008, page 3.]

Applicants respectfully submit, however, that Young's teachings do not cure the deficiencies of Applicants' Figure 2, for several reasons.

First, the cited components of Applicant's Figure 2 cannot teach "**an electrode** comprising: a first conductive layer; a dielectric layer ... ; an adhesion layer ... ; a second conductive layer ... ; and a third conductive layer ...," as claimed, because component 210 (cited as teaching the recited third conductive layer) is part of one electrode and components 110 and 112 (cited as respectively teaching the recited adhesion layer and second conductive layer) are part of another electrode. If these components 210, 110, 112 were drawn into direct physical contact with another, the device of Applicants' Figure 2 would be rendered unsatisfactory for its intended purpose and inoperative by requiring either removal of the memory element 200 or the shorting of current away from the memory element 200 (because components 210 and 110 are configured as respective terminals of the memory element 200). See MPEP 2143.01. In other words, the Office Action improperly ignores the functionality of the memory element 200 in an attempt to meet the claim limitations.

Second, Young does not suggest arranging the conductive layer 210 in "direct physical contact with" the conductive layer 110 and adhesion layer 112 "to obtain an electrical connection between second interconnection and the via," as asserted by the Office Action, because the conductive layer 210 is already electrically connected to the

conductive layer 110 and adhesion layer 112 by way of the memory element 200 (as also noted by the Office Action, January 28, 2008, page 3).

Third, neither Applicants' Figure 2 nor Young suggests (or are cited as suggesting) recessing the conductive layer 210 of Applicants' Figure 2 within the dielectric opening 106 to cap the conductive layer 112 and adhesion layer 110 within the dielectric opening 106. In that regard, Applicants note that Young's conductive layer 38 does not cap the adhesion layer 36. Thus, the proposed combination of Applicants' Figure 2 and Young does not teach the recited feature that "said third conductive layer is recessed within said opening to cap said second conductive layer and said adhesion layer within said opening."

Accordingly, for at least the above reasons, Applicants respectfully request that this rejection be withdrawn and the claims allowed.

As all outstanding issues are addressed by this response to the outstanding Office Action, favorable reconsideration and allowance are solicited. If, however, there are remaining issues which can be addressed by a discussion with Applicants' representative, the Examiner is respectfully requested to contact the undersigned attorney, Steven Dickey, at (202) 420-4756. Further, if there are any additional charges in connection with this filing, the Examiner is respectfully requested and authorized to charge Deposit Account No. 04-1073 therefor.

Dated: April 28, 2007

Respectfully submitted,

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